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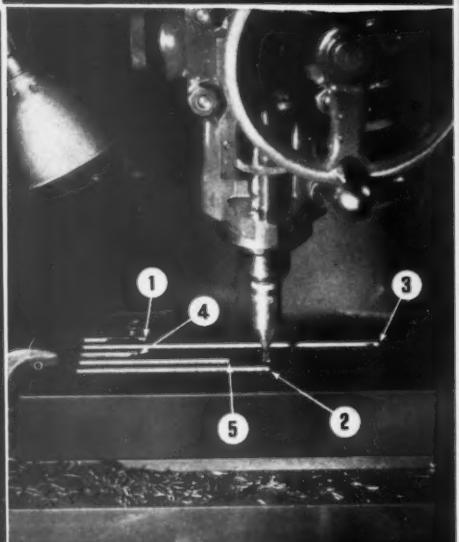

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The National Tool and Die Journal

Editor
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Assistant Editor
Paul L. Reed

Official Organ of the Special Tool, Die and Machine Shop Institute

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CONTENTS

A First Look at Plastic Molding—Paul L. Reed 9
Die Designing and Estimating (XI)—George Dannes 13
Continental Introduces New "DoAll 26" 17
Reducing Cost of Precision Small Hole Lapping 18
New Armstrong Bros. "Tool Holder Encyclopedia" 18
A Jig for Drilling in Two Different Planes (Conclusion)—Edward Heller. 22
Catalog Review 26
Buy with Confidence Directory 29
Contract Shops 36, 37

Advertisers In This Issue

Acme Industrial Company 29
Ajax Steel & Forge Co. 32
Arlavox Mfg. Company 34
Armstrong-Blum Mfg. Co. ..... Back Cover
Barth Stamping & Machine Works 36
Bates, H. O. 34
Bissett Steel Company 38
Bunell Machine & Tool Company ..... 7 and 36
Cleveland Universal Jig Company 36
Columbia Tool Steel Co. 33
Continental Machines, Inc. 5
Danly Machine Specialties, Inc. 6
Darwin & Milner, Inc. 24
Davis Tool & Engineering Company 36
Denning Manufacturing Company 37
Detroit Alloy Steel Co. 8
Detroit Stamping Company 34
Drive-All Manufacturing Co. 30
Enterprise Machine Parts Corp. 36
Foley Manufacturing Co. 28
Forging and Casting Corporation ..... Center Spread
Gallmeyer & Livingston Co. 35
Gear Specialties, Inc. 19
Gerstner Tool Chests 34
Grobet File Corp. of America 33
Hahn Manufacturing Company 37
Hamilton Tool Company ..... 23 and 37
Hanna Engineering Works 3
Hartford Special Machinery Co., The 33
Hovis Screwlock Company 31
Industrial Machine Company 37
Kiffer Tool & Die Co. 37
Knu-Vise, Incorporated 38
Koestlin Tool & Die Corp. ..... Inside Front Cover and 36
Lincoln Tool & Die Co. 36
Majestic Tool & Mfg. Co. 36
McKinney Tool & Manufacturing Co. 37
Modern Tool & Die Company 37
New Method Steel Stamps, Inc. 35
Northeastern Engineering Company 36
Ohio Tool Company 37
Paramount Tool Company 37
Phoenix Machine Company 37
Porter, Geo. H., Steel Treating Company. 38
Putnam Tool Co. ..... Front Cover
Robbins Engineering Co. ..... 27 and 36
Royal Oak Tool & Machine Company 36
Saf-Way Steel Treating, Inc. 32
Schraner, A. P., & Company 37
Sommer & Adams Co. ..... Inside Back Cover and 37
Star Machine & Tool Company 37
Star Tool & Die Works 36
Strong, Carlisle & Hammond Co. 25
Tools & Gages, Inc. 37
Ulmer, J. C., Company 37
Variety Machine & Stamping Company ... 37
Wittek Manufacturing Co. 38

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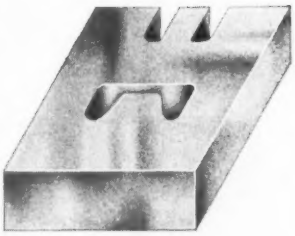

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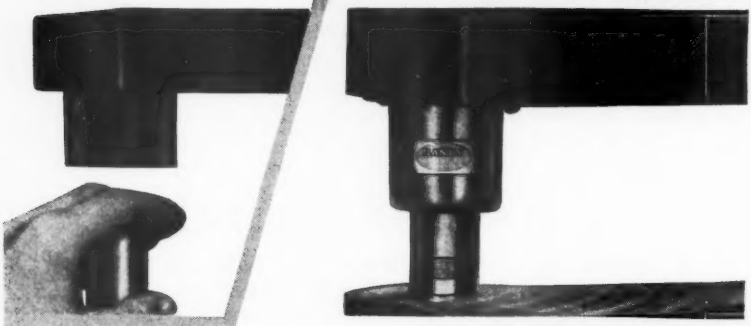

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Tool • Die • Machine **PROGRESS**

The National Tool and Die Journal

November, 1939 **Vol. 5, No. 8**

A **Reader Requested** Article

A First Look at Plastic Molding

By Paul L. Reed
Assistant Editor

AS the average tool and die shop comes to understand the fundamental principles of plastic molding, mold design resolves itself into a number of operations which are readily understood.

There is no mystery about plastics. They are materials that in process, can be formed into any desired shape that will retain that shape. Plastic raw materials, many of which are quite ordinary and very abundant, are changed by the industrial chemist in an amazing number of combinations of synthetic products which can be cast, molded or pressed into an almost unlimited variety of shapes. The oldest commercial plastic is advertised by one leading manufacturer as available in more than 4,000 colors, configurations and mottles in stock samples. No one has even catalogued all the textures, colors and configurations that can be obtained.

There are two general types of molding—compression molding and injection molding. Compression molding is by far the older and most widely used. In compression molding the plastic material is placed in a mold cavity from which one side, usually the top, has been removed; the sides are extended high enough to hold the material. The top is then forced down, usually by hydraulic pressure. closing the cavity as the molding granules or slab is reduced to the required plasticity. Pressures of 3,000 pounds per square inch or more are used, the higher pressures giving quicker cycles. Such molds are usually heated by steam under 150 pounds pressure, temperature being carefully controlled after a setting for each lot has been determined by test. Compression molding permits the cheapest press assembly and allows the cheapest mold construction.

Molding material may be in various physical stages; it may be a powder, a pre-formed pill or slug, or it may be a molten mass. Various details of design must be adapted for each of these types of materials. In many compression molds, it is necessary to both heat and cool the molding. This is usually done by steam lines built into the molding equipment. Several types of molded plastics in wide use require cooling before ejection.

Molds are made of hardened, ground and polished steel. Hardened for strength under the high pressures and for wear against the flowing material, ground for accuracy in fit for contacting parts and accuracy of dimension in the resultant piece, polished to reduce frictional resistance to the flow of the molding material and for better final appearance of the material. Even overflow or flash areas should be polished to permit excess material to slide out easily and thereby reduce the work of trimming the flash in finishing. Slight, deliberate undercuts

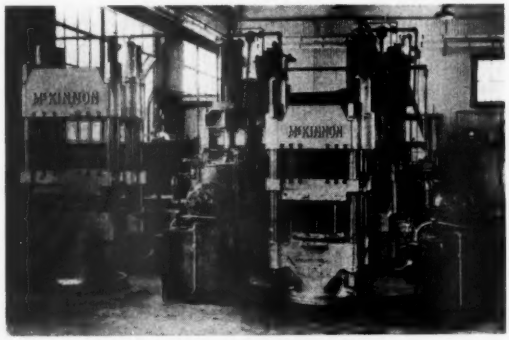
Multiple cavity molds can be made from a single original. A Bakelite mold is being duplicated on a Gorton 8½ D Duplicator

are permitted on some types of plastics to make the part stay in the chase or on the force plug as may be desired. Care must be exercised in making these undercuts or the piece will crack in passing over them. It is usual practice to put these undercuts in after the mold is set up so that experiment can indicate how far one may safely go. It is hard to back track on undercuts once they are in the mold.

The simplest variation of compression molding involves the use of a separate mold or die which is self-contained and designed to be manually handled by the operator. It is loaded on the bench, capped, placed in the press, closed and cured there and then removed for opening usually under an arbor press. In many cases the same mold, properly designed, can be bolted permanently into the press and opened and closed as the press opens and closes. The press must have a positive up and down movement of the pressure instead of the usual gravity drop found in the standard hand press.

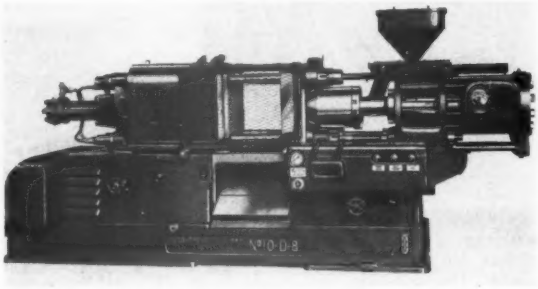
In the simple overflow mold, the design must allow for correct flash. Improper fitting or incorrect design may cause breakage or crackage of the die. The same attention must be given in mold design that is given to dies which are to be used in specific stamping presses where metal is formed or worked. Every mold must be designed with the press in which it is to be made, kept consistently in mind.

The simplest design for compression molding is a part which has no undercuts, from which the plunger may be withdrawn directly and which will come free

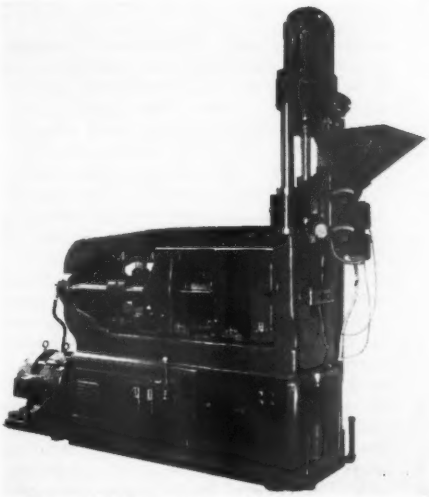


A recent installation of two compression molding machines at the Vlchek Tool Co., Cleveland, O. Many tool and die shops are equipping themselves to do this type of work

from the chase in its upward movement. Where under cuts or side holes are necessary, side pins must be moved back and forth before the mold is opened. Side plates may have to be ejected as an integral part of the piece and taken off the piece outside the mold. In other words, this is somewhat the same problem that the die designer has in cam action dies for stamping presses.



The injection molding machines shown (Reed-Prentice Corp., right; Index Machinery Corporation, below) are typical of modern high-speed automatic injection equipment

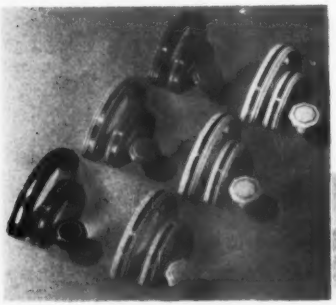


The molded part may have to be removed from the chase by ejector pins which are likely to leave their mark on the surface of the molded part. Such marks are frequently very slight and can be removed with any method of finishing which may be applicable to the type of molded product being made. Where such marks are not permissible, slight undercuts are placed on the plunger so that the piece tends to stick at that point when withdrawn. In this case, it is knocked off the plunger by ejector pins. In some cases a blast of air is used for ejecting.

So many types of plastics are being molded today that every mold and every plastic material is a problem unto itself and the shop that attempts to design a mold for a specific plastic should understand the press characteristics of the plastic, the operation of the press and have an idea of the skill of the press operator. Unless a designer has had experience in the specific type of application he is called on to do, he should call in a mold designer who has had such experience. There is no other way of avoiding subsequent troubles and difficulties.

The other type of molding which is becoming more and more popular in the last few years is injection molding. This system varies essentially from compression molding in that the material to be molded is heated outside the mold chamber, usually in a heating chamber which is part of the machine itself; the material is then forced through a nozzle under pressure into the closed mold cavity. The mold closes, the piece is formed, the mold opens and the piece is ejected. Each repetition of the process constitutes a cycle. Up to the present time, practically all injection machines are designed for a small weight per shot of heated material and a small area of molded piece. While one machine is in successful operation that handles material up to 36 ounces most machines now in successful opera-

tion handle an average of 4 ounces shots with an area of approximately 30 square inches. Present technical difficulties, still formitable, place a practical limit of about 10 ounces per shot on injection molding. The few larger injection machines use multiple heating and injection units. One essential difference in design is that the injection molding is a closed molding operation while compression molding is an open molding operation.



Left, Colorful molded knobs and drawer pulls are typical multiple mold products Right below, A transparent molded closure for mineral acids
Photos courtesy Bakelite Corporation

Above, Torpedo molded level is oil, grease and water resistant.

Injection molding machines themselves consist of a horizontal bed plate on which is mounted a head cylinder with a plunger which forces an exactly measured shot through a nozzle into the mold chamber. Since the mold operation is only to put pressure on the completely filled mold cavity itself, the molded material is removed with practically no flash trim except through the entering gate. The mold is opened and closed usually by a hydraulic cylinder, in some cases with a mechanical toggle action auxiliary pressure. The mold is usually chilled by water circulation.

One advantage of the injection machine is in its rapidity of operation. On the average one cavity in the injection machine is equal to the production capacity of 10 cavities in a pressure mold. In some cases multiple cavities are also used in injection machines, particularly in the making of very small parts. The compression machines, of course, are frequently of the multiple cavity type.

Very careful control of temperature of the molded material and of the press operation cycle have been worked out so that in many of the new machines the entire operation is fully automatic. While this tends to make the injection molding machines expensive, they have advantages which make them practical.

The first advantage that injection molding has over compression molding is that the mold is virtually filled before the molding pressure is applied. This prevents the swirling of material common in compression molds which has a tendency to snap off hardened tool steel pins and to break inserts away from their anchorages. In this respect the injection mold design in some cases has more freedom in designing thin wall sections or intricate designs. The second advantage of injection molding over compression molding is that there is considerably less flash or surplus material except at the gate or sprue hole itself. The injection molded piece should be perfect and need finishing only under special conditions. The wear incident to excessive flash is not encountered with injection molding. Finishing operations in most cases have to be done by hand and this is expensive. For example the average cost of finishing press molded pieces runs about two-thirds of the cost of molding. Injection molding very largely eliminates such a finishing cost. In general large pieces are compression molded; small pieces or parts injection molded.

In molding there is no short cut to good results. The same necessity of the use of the finest and most appropriate tool steel and the same understanding of the results which are to be accomplished are necessary as in ordinary die design. Attempts made to cut the cost of molds in their making are likely to prove expensive to the buyer in production.

Die Designing and Estimating

Advanced Series

XI

By GEORGE DANNES

George Dannes is superintendent and engineer of the Permoflux Corporation of Chicago, and instructor in the advanced class studying Die Designing and Estimating at the Carl Schurz High School under the auspices of the Chicago District of the Special Tool, Die and Machine Shop Institute.

The Dannes method of die estimating has been detailed in previous issues. This article carries through the entire procedure for a compound die. Next month a more complicated progressive die, the design of which incorporates miscellaneous unique features, will be studied.

For an important announcement regarding this series, see page 35.

—*The Editor.*

THE METHOD APPLIED TO A COMPOUND DIE

FIG. 33 illustrates a part, the specifications for which require that all burrs be on the under side of the blank, which to the die designer means that all operations must be carried forward in the same direction. The progressive type of die is not suitable because it would burr the holes and the key slot on the side opposite to the burr around the contour of the blank.

The compound type of die was chosen for two principal reasons: 1, to assure forming all burrs on the same side of blank; 2, to obtain a flat blank as specified. The latter is largely a matter of "hitting home" with the shedder. Fig. 34 shows the general construction of the die and its principal working parts. According to Table 2 for determining die block thickness, ¾" should be sufficient for the quantity and the stock thickness specified; but in this case it is necessary to use a 1" die block to accommodate a shedder with sufficient strength to withstand the steady succession of severe blows necessary to flatten the blank. All working parts of the die are made of oil hardening tool steel; punch plate, stripper, backing

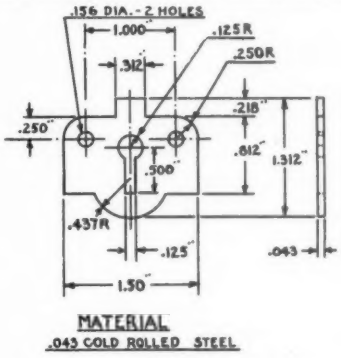
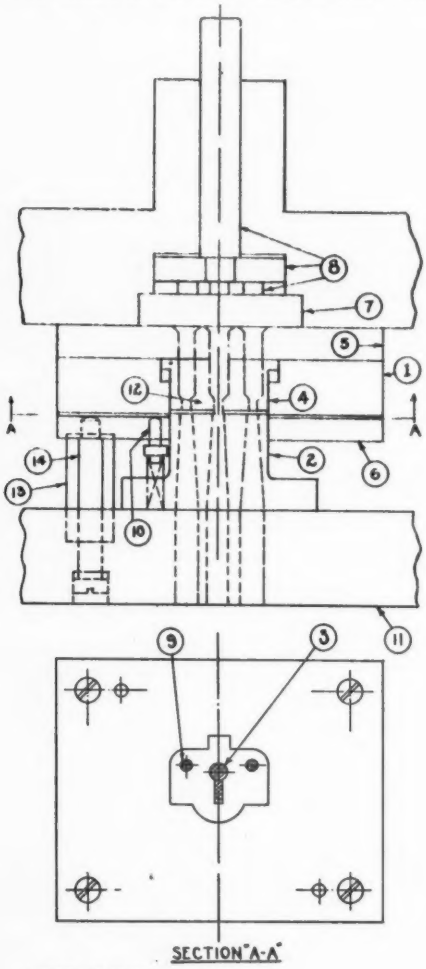


Fig. 33

Fig. 33—Part drawing. Tolerance: Flat within ± .002". Note: All burrs must be on bottom side of blank. Quantity: 50,000 through season

plate and the knockout parts are cold rolled steel.

The design of the die is quite conventional—nothing out of the ordinary. Punch No. 2 is mounted on the die shoe No. 11 and the snug fitting stripper No. 6 which is supported on spring No. 13 also on the die shoe, make up this assembly. The stripper has three spring pins two of which are used as back gages while the third serves as a stop. These pins are shown as No. 10 on the die layout.



SECTION "A-A"

1—DIE BLOCK 1" x 4" x 5" TS
2—PUNCH 1½" x 2" x 3" TS
3—PUNCH ½" x ¾" x 1½" TS
4—SHEDDER 1" x 1½" x 1¾" TS
5—PUNCH PLATE ½" x 4" x 5" CRS
6—STRIPPER ½" x 4" x 5" CRS
7—BACK PLATE ½" x 2¼" Dia. CRS
8—KNOCKOUT, TYPE 3
9—PERFORATORS, TYPE 1
10—SPRING STOP
11—LEADER PIN DIE SET 5" x 6"
12—OIL PIN
13—STRIPPER SPRING
14—STRIPPER BOLT

Fig. 34

The die block No. 1 is mounted with the punch plate No. 5 on the punch holder. The shedder No. 4 is mounted in the die. It is provided with a shoulder on its upper end which limits its movement and at the same time prevents it from falling out of the die. There is clearance in the shedder for the two perforators and also for the key slot punch. Another important item in the shedder is the oil pin which consists of a ball bearing actuated by a spring inside the shedder. This die part is very necessary to break the oil film between the shedder and the piece part, thus preventing the latter from adhering to the shedder when it is out of the die and insuring blanked piece dropping free. This oil pin, although a small item, is important and must not be forgotten. Die breakage can, to a large extent, be traced directly to its omission because without it, it is very easy to have two pieces in the die at one time, the one, which because of the oil film still adheres to the shedder, and the second which is in position to be blanked out. In this type of die this is dangerous because the press is set to "bottom" the shedder with each down stroke thereby flattening the piece part. Because there is not room in the die to accommodate two piece parts, something—usually the weakest part of punch or die—has to give. Often the press operator is blamed, but it is neglect of such small items as this which should make either the designer or the diemaker responsible for such a breakdown.

All perforators and the key slot punch are mounted in the punch plate against a backing plate for which a step hole is cut into the punch plate as well as for the type 3 knockout which is being used. Three knockout pins actuate the shedder and the clearance holes for these are drilled through both the punch and back plates.

This should suffice as a description of the construction of the die and we ought to be able to estimate the time required to build it. Again using the now familiar standard estimating form (Fig. 35) we begin with the die block which in this instance we will designate die No. 1.

MACHINING AND GRINDING	Machining hr.	Grinding hr.
DIE No. 1 Dimensions 1" thick x 4" wide x 5" long. See Table, Fig. 6. Grinding preparatory to layout and again after heat treating requires use of time value equivalent to 100% of squaring time plus .2 hr. for set-up	.7	.9
DIE No. 2 For the key slot, requires no record in Column A because there is no machining of this kind.		
PUNCH No. 1 (No. 2 in drawing) 1½" x 2" x 3" made of TS Table Fig. 6	.5	.7
SHEDDER 1" x 1½" x 1¾" TS	.4	.6
PUNCH PLATE ½" x 4" x 5" CRS, therefore 70% of time value in Fig. 6. (50% of squaring time plus .1 hr. for set-up)	.4	.3
STRIPPER ½" x 4" x 5" CRS, therefore 70% of time value in Fig. 6. (50% of squaring time plus .1 hr. for set-up)	.4	.3
BACKING PLATE ½" x 2¼" diameter CRS. Table 6. Dimensions ½" x 2¼" x 2¼"	.3	.2
KNOCK-OUT Time for making knockout parts shown in Column E.		
TOTAL Column A		5.7 hrs.
DRILLING OR BORING SCREW AND DOWEL PIN HOLES AND ALL OTHERS EXCEPT PERFORATOR AND PILOT HOLES.		
DIE BLOCK 4 screw, 2 dowel pin holes respectively ⅜" and ⅞" according to Table, Fig, 7, 6 @ .1 hr. .6 hr. Set-up time for group .1 hr. Total		.7 hr.
PUNCH No. 1 2 screw and 2 dowel pin holes	.5	

DIE WORK ESTIMATING SHEET

	A	B	C	D	E	F
DIE No. 1	.7 .9	.7	1.0	9.0 1.0		3.0
DIE No. 2			.3	4.0 .4		
PUNCH No. 1	.5 .7	.5		10.0		2.0
PUNCH No. 2				2.0		1.0
SHEDDER	.4 .6			8.0 2.0		1.0
PUNCH PLATE	.4 .3	1.0		.8		
STRIPPER	4 .3	.5		1.8		
BACKING PLATE	.3 .2	.4				
PERFORATORS			.4		1.0 2.6	1.0
KNOCK-OUT					3.5	
SPRINGS		2.0				
STOP					3.0	
OIL PIN					1.7	
TRYOUT						2.0
INSPECTION			1.5 .8			
SHOE		.9		.8		
HOLDER		.7				
	5.7	6.7	4.0	39.8	11.8	10.0

TOTAL 78.0 hours

Fig. 35

PUNCH No. 2
Requires no holes because set into punch plate.
SHEDDER
Has no holes except clearance for perforators and key slot punch, time for which is estimated in other columns.
OIL PIN
Same explanation.
PUNCH PLATE
4 screw holes, 2 dowel pin holes, 3 holes for knock-out pins. 9 holes x .1 hr. plus .1 hr. for set-up. Total 1.0
STRIPPER
4 screw holes, same method of calculation 5
SPRING PINS
Holes for these included in total spring pin time estimates in Column E.
BACKING PLATE
3 holes for clearance of knock-out pins 4
PUNCH HOLDER
6 holes 7
(Hole through shank is included in the time estimate for making the knock-out)
DIE SHOE
4 holes for stripper bolts and 4 holes for "tying down" punch 9
Add drilling and counter boring 4 spring holes at .5 hr. each (Table, Fig. 8) 2.0

TOTAL Column B ..... 6.7 hrs.

LAYOUT AND INSPECTION
Contour characteristics of the part—straight, angular and curved lines, radii dimensions, etc.—determine time required for layout. Inspection is directly related to tolerance specifications. Use part drawing, Fig. 1 and tables, Figs. 9 and 10.

Layout

DIE No. 1
10 contour units ..... 1.0 hr.
DIE No. 2
3 contour units 3
PERFORATORS
2 contour units 4

Inspection

No tolerance having been specified, it may be considered as ± .005", and the time allowed for each die opening is .5 hr. added to layout time,
DIE No. 1
1 hr. plus .5 hr. ..... 1.5 hr.
DIE No. 2
.3 hr. plus .5 hr. 8

TOTAL Column C ..... 4.0 hrs.

MACHINING AND FINISHING OF DIE PARTS. Description, illustrations and Tables 14, 15, 16, 17.

	Rough hr.	Finish hr.
DIE No. 1		
Perimeter approximately 6", contour units 10, time required	9.0	1.0
DIE No. 2		
Opening consists of 3 units, closest table value 4 units. Perimeter approx. 1".	4.0	.4
PUNCH No. 1		
Type 2 construction according to Fig. 17. Contour units 10, size 6". Use Table, Fig. 16, 8 units and 8" size making time required practically		10 hrs.
PUNCH No. 2		
Type 1 construction. Units 4, size 1"		2 hrs.
SHEDDER		
Type 2 construction having a shoulder as shown in Fig. 17. Contour units 10, size 6" but use 8 units and size 8"		8 hrs.
Note: Opening for No. 2 punch, see Fig. 16. Units 4, size 1". Time		2 hrs.
PUNCH PLATE OR PAD		
Opening for No. 2 punch 4 units 1"		.8
STRIPPER		
Opening for No. 1 punch—use 12 units and 4". Time ..		1.8
Note: Clearance hole for the No. 2 punch slug in the die shoe 4 units size 1"		.8

TOTAL Column D ..... 39.8 hrs.

Accessories

PERFORATORS
See Fig. 21 for types; Table, Fig. 22 for making and finishing perforators and pilots and Table, Fig. 23 for finishing perforator holes; 2 perfora-

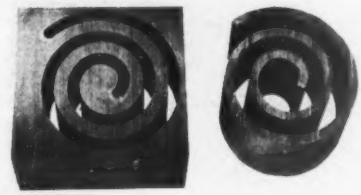
(Continued on Page 34)

Continental Introduces New "DoAll 26"

Two New Machining Processes Possible With Redesigned Machines

CONTINENTAL Machines, Inc., announce their new "Doall 26" which features a newly designed automatic power work feed, a frictionless cutting attachment and a greatly increased capacity for a machine of its type.

The new automatic power work feed not only exerts pressure into the saw, but, according to the company, throughout the contour as well. No hand pressure is required for any type of cut; any curve for example can be cut by hand



wheel control. The spiral part cut from 2½" thick forging steel was made with this new work feed, being machined with the feed in only one hour and 48 minutes. The automatic feed greatly amplifies the machine work capacity.

The frictionless cutting attachment permits easy machining of heavy work. It is said that improvements have been made in almost all of the assemblies of the machine providing easier operation on a wide range of work. The massive, rugged machine weighs over 2000 pounds; a 1½ HP motor drives the unit through the Speedmaster molded bakelite variable drive and through a silent transmission of eight helical gears, which run in oil.

Capacities in the "Doall 26" have been greatly increased. The 30" x 30" work table is of the strongest box type construction. Precision band saws from 1 mm up to and including 1 inch (previous models took saws to ½" wide) and a new ½" wide file (the ⅜" and ¼" can also be used) brings many more jobs within the scope of the machine.

Two new machining processes are made possible by the redesigned Doall machines. The first is a method of making "stampings" without dies. Sheets of the required thickness are stacked up and then secured at the corners by weld-

(Continued on page 19)

Reducing Cost of Precision Small Hole Lapping

EX-CELL-O Corporation of Detroit announces a new Internal Lapping Machine designed to increase the accuracy and reduce the finishing cost of small (¼" to 1" diameter) holes. This is one of the machines that was to have been introduced at the Machine Tool Show.

The machine is particularly adapted to improving the quality of finish and roundness of holes that are difficult or unsuited for other high precision finish machining methods such as internal grinding. Holes interrupted by keyways, milled or cored slots, cross holes, etc., are quickly and accurately lapped on this machine. Small relatively long holes can be finish lapped directly after broaching or reaming.

The features claimed for the Ex-Cell-O Internal Lapping Machine include: high rate of output; long lapping stone life; operating convenience; ease of adjustment for size of hole; ready interchangeability from one hole size to another.

A special feature is the unique design of lapping stones and holders and the fact that the lapping stones can be expanded at any place in the hole. The detailed photograph shows a micrometer control on the knurled spindle sleeve to prevent expansion of the lapping stones beyond a predetermined size setting. For quick change-over, a bayonet lock holds the lapping mandrel in the spindle and a knurled nut retains the lapping stones.

Literature describing the Internal Lapping Machine completely has just been prepared and will be sent on a request addressed to Ex-Cell-O Corporation, 1228 Oakman Blvd., Detroit, Michigan.

New Armstrong Bros. "Tool Holder Encyclopedia"

A NEW CATALOG, which is virtually the *tool holder encyclopedia* and as such is indispensable to superintendents, supervisors and shop men generally, has been compiled by Armstrong Bros. Tool Company, "The Tool Holder People", and is ready for distribution.

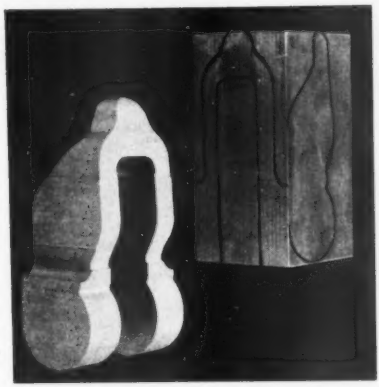
Of particular interest is a patented extension shaper tool, adapted for die work and cutting of internal keyways and for the numerous types of work which require extra clearance. An unusually efficient accessory is a planer tool on which the cutter can be reversed thus enabling it to operate like a "goose neck". In corners where clearance is small this cutter can be adjusted for angles which otherwise might require changing the position of the work piece. Also among the new items which are described and illustrated are hollow screw wrenches packed in sets complete with detachable head wrenches, handles, extensions and ratchets for all hexagon socket hollow screws from ¼" to 1" in diameter, made

(Continued on Page 27)

New "DoAll 26" Redesigned

(Continued from page 17)

ing, soldering, clamping or other means. On the parts illustrated, 50 sheets of .020" thick lamination steel were stacked up and "tack" welded at the ends. A layout on the top sheet was made for the two parts shown. These were then sawed out on the new "Doall 26" in only 35 minutes. The lever part required 22 minutes sawing time and the lamination part required 13 minutes sawing time. Any holes required in the parts are drilled in the stack before the sawing operation. If close tolerances are to be held at any point on the "stampings" the cutout parts can be secured together through the holes and then filed on the Doall to the exact size required.



The second machining process is the production of short run "forgings". The poppet valve lever illustrated is a typical example of a short run "forging". Twenty of these levers were required for experimental use. To make forging dies for twenty levers, of course, was out of the question. To machine them by any other method would have been costly and the completion of the parts would have been greatly delayed. This three dimensional part was machined on the Doall in only three hours. A wide use of these two new machining processes is now being made on a variety of "stampings" and "forgings".

For complete specifications of the new "Doall 26" write Continental Machines, Inc., 1303 So. Washington Ave., Minneapolis, Minn. Please mention TDM PROGRESS.

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A Jig for Drilling in Two Different Planes

By Edward Heller
Chief Tool Engineer
Ohio Tool Company

(Concluding Installment)

FIGURE 3 shows the mathematical projection of the holes C and D intersecting the plane F-F, establishing points M and N as shown in views E-E and E_1-E_1 respectively. By solving simple right-angled triangles we get the dimensions .8113", .3669", .5324" and 2.0834" (see assembly drawing).

In making the jig, the four pins Z were located at convenient predetermined places in the box of the jig body, while the casting was clamped to the boring mill table on temporarily inserted feet O.

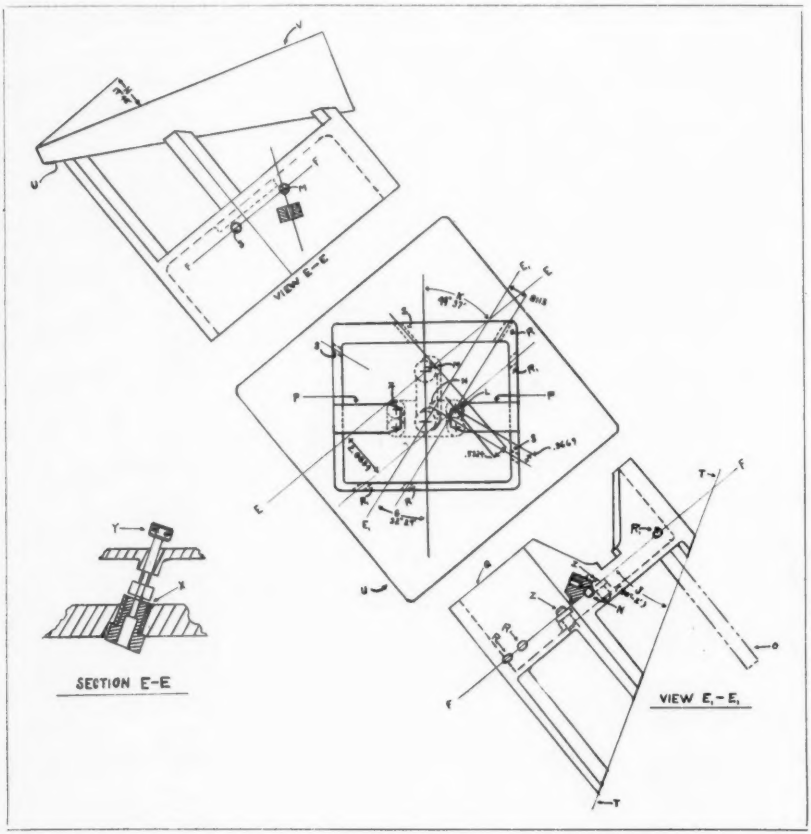

Fig. 3

These were made parallel to plane F-F or the top face Q of the box while in this setup. Construction holes R-R, S-S, R_1-R_1

and S_1 were bored.

It will be noted that these holes or points establish a definite tie-up between the point L on the flat surface of the work and the projected points M and N for the holes to be drilled.

The casting was then clamped to an angle plate on face Q so that line E_1-E_1 was horizontal; then the angle plate proper was turned until the face of the angle plate, i.e. the face that was in contact with face Q made the angle J (30° 2′, see October installment) with the plane of the cutter. While in this position, the feet were machined on line T-T. The feet were then at the proper angle to drill the hole in boss D.

To accommodate boss C, a filler plate U was put under the jig. For machining purposes, the plate was actually fastened with screws to the jig feet at T-T. The box was clamped to the angle plate as in the previous operation, on face Q, but with line E-E horizontal; then the angle plate was turned until the face in contact with Q made the angle H (17° 48′, see October installment) with the plane of the cutter. While in this position face V-V of the filler was machined.

Before the filler plate U was removed from the jig box casting, a nest (not shown), consisting of cold rolled strips, was securely screwed and dowelled to the low sides of the filler face, so that the jig feet would always come in contact with the filler block in the same spots.

The jig was sent back to the bench where the lid W was fitted, after which it was ready for the boring of the drill bushing holes.

At this time the jig was fastened to the angle plate, with the plane of the feet T-T in contact, and that plane square with the boring spindle. The casting was trued-up by means of the construction holes R-R until the line E_1-E_1 was either vertical or horizontal. By moving .8113″ in the direction away from R-R, and .3669″ from S-S, the location for the center of hole D was established. For the hole C, the jig body was fastened again to the filler U and while face V-V was in contact with the angle plate, the casting was adjusted until line E-E was either horizontal or vertical. The exact location for the center of hole C as then found by moving .5324″ from S_1, and 2.0834″ from R_1-R_1.

It will be interesting to note that, while the description given is for the machining of the cast iron part, the same procedure had to be followed in making the pattern for the box, as well as for the filler U.

As mentioned before, the job was located on four pins Z and held down upon the large heads of these pins by means of flat sliding strap clamps (P), with studs and nuts. The over-hanging end B of the casting, Fig. 1 (see October installment), was supported by a long hollow jack screw Y. The diameter of the head and the pitch of the thread on this screw are of such proportion that it can be brought only in contact with the small casting, thus not springing it.

The large body size of the slip bushing X was necessary to allow a spot facing tool to go through the liner bushings and finish the faces of the bosses after drilling.

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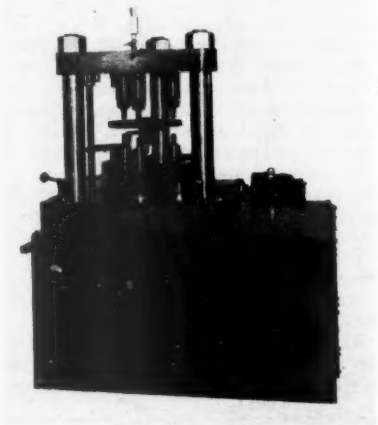
Hanna Adds Gear and Hub Assembly Riveter

THE Gear and Hub Assembly Riveter, the latest addition to the Hanna Electric Hydraulic Riveting line, offers an interesting application of multiple riveting for production work in a machine tool that has been designed for fast, trouble-free operation. In design the riveter is a press of the strain rod and platen type.

There are three pairs of dies for driving three rivets 120° apart simultaneously. The upper set of three dies is stationary and the rivets are headed by a set of three lower movable dies. Each pair of dies acts independently of the other pairs although the tonnage on all pairs is exactly equalized. Thus no harm to the assembly nor to the press will result should two rivets or one rivet be struck instead of three.



This press is provided with a swing-out arm and mandrel for loading and sticking (assembly) of the work in a handy and safe manner. The rivets are inserted from above with the manufactured head up. When the swing-out arm is swung in against the stop the axis of the assembly is accurately located in relation to the dies. The operator then merely rotates the work until a set of three rivets comes into index with the dies. Depressing a foot treadle causes the assembly to be lifted to nest the manufactured heads of the rivets up into the

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stationary upper die cups. The press is controlled by two hand levers, a safety feature which assures the operator's hands being free of the dies.

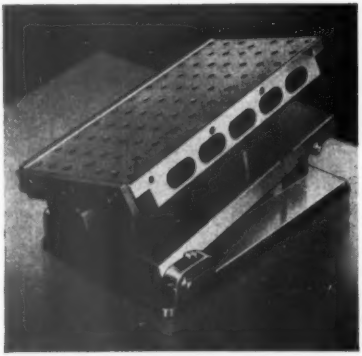
This press is operated by low pressure oil (1,000 lbs. per square inch) at which pressure 25 tons are exerted between each pair of dies. This tonnage is adjustable and accurately maintained. The operation is very rapid—twenty cycles per minute of 3" stroke.

For details of the Hanna Gear and Hub Assembly Riveter write Hanna Engineering Works, 1759 Elston Ave., Chicago, Ill. Please mention TDM PROGRESS.

Robbins Markets New Non-Magnetic Sine Plate

THE Robbins Engineering Company, Detroit, Michigan, has recently developed a new non-magnetic sine plate to supplement the Magna-Sine line. It is intended to be used only in inspection departments for accurate checking of angular machining work.

This new product is built on the same principle as the Magna-Sine, and utilizes standard gage blocks for adjusting the plate to the required angle or combination of angles. It is available in the same sizes and is manufactured to the same precision limits as the Magna-Sine. Its construction throughout is of oil hardening steel. Both compound and single angle types are furnished.



Because this sine plate incorporates no magnetic coils, its cost is lower and it is much more economical for inspection use than the magnetic type of Magna-Sine.

Full information on the Non-Magnetic Sine Plate will be sent on request. Write the Robbins Engineering Co., 637 Mt. Elliott Ave., Detroit, Mich. Please mention TDM PROGRESS.

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The Catalog Review

Brief descriptions of current industrial literature including technical booklets and bulletins, catalogs and circulars. All may be had upon request, without charge. . . . Please use identification numbers.

LUFKIN'S PRECISION TOOL CATALOG No. 7, describing and illustrating such tools as micrometers, squares, indicators, rules and a wide range of gages including radius, thickness, screw pitch, universal surface, telescoping, center, depth and planer and shaper gages, has been issued by the Lufkin Rule Co. Catalog No. 7 illustrates most tools and gives packing and shipping information. All prices for all tools in the line are given. The tables of useful shop information, the alphabetical and numerical indices make the 128 page catalog helpful and convenient for frequent reference. For a copy of Precision Tool Catalog No. 7 write the Lufkin Rule Co., Saginaw, Mich.

T-J REMOTE CONTROL SYSTEMS are illustrated and described in the Tomkins-Johnson Co.'s Bulletin RC-4 just issued. This line of pneumatic controls accomplishes instantaneous control for hydraulically operated machines, is adaptable to any type of operation and secures maximum speeds while safeguarding workers. The Bulletin shows a number of applications on presses, brakes, and shears. Various "button" and "main" valves are shown and their specific applications indicated. Installation diagrams help make this Bulletin valuable. For a copy of Bulletin RC-4 write the Tomkins-Johnson Co., 630 N. Mechanic St., Jackson, Mich.

WITTEK ROLL FEEDS AND REEL STANDS for automatic feeding of punch presses, made in types to meet every requirement in feeding stock from coils and to fit all sizes and makes of punch presses are described in Catalog WF-339 issued by The Wittek Mfg. Co. The Feeds, in their improved and simplified method of operation are highly flexible in function and application and eliminate complicated parts and insure rapid, smooth and accurate feeding under all conditions. Wittek Reel Stands have a unique design of the swivel mounting, equipped with an outer retaining ring and adjustable spring-tension brake. Well illustrated, including schematic views of the Roll Feed, specifications and prices, Catalog WF-339 may be obtained by addressing Wittek Manufacturing Co., 4307 West 24th Place, Chicago, Illinois.

MEEHANITE RESEARCH BULLETIN No. 9P—Meehanite, the Metal for Machine Tool Castings, reviews the properties of five grades of specially processed cast iron alloys and lists practical applications to machine tool construction. Meehanite castings are shown in a wide range of parts including tailstock, headstock, gear box, face plates, lathe chuck, cams for crankshaft lathe, slides, spindles and spindle carriers, tool blocks and such metal parts of hydraulic equipment as hydraulic tailstock cylinder and casing, head raising cylinders and work head guides. The engineering chart and graphs giving various properties are valuable to the machine designer. For a copy of Bulletin No. 9P, write Meehanite Research Institute of America, Inc., 311 Ross Street, Pittsburgh, Pa.

THE NEW 36-PAGE CERROMATRIX MANUAL just released, includes a number of new applications for this low-temperature-melting alloy, which are explained in enough detail to be practical for the die shop. The Manual is profusely illustrated. Methods for reclaiming cracked dies and for holding machine parts and irregular shapes in drill jigs are also illustrated and discussed. The greater part of the Manual is given to illustrations of Cerromatrix in use to

(Continued on next Page)

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New Cerromatrix Manual

(Continued from Page 26)

locate blanking, piercing and trimming punches in relation to dies without the need of machining non-working surfaces to close dimensions. For a copy of Cerromatrix Manual TD, write Cerro de Pasco Copper Corporation, 44 Wall Street, New York, N. Y.

"Tool Holder Encyclopedia"

(Continued from Page 18)

of chrome vanadium steel, heat treated, finished in chrome over nickel.

Armstrong patented boring tools have numerous practical advantages. "A half turn of one screw clamps or releases the bar which can be extended from the shank or holder to any desired length, giving the greatest degree of stiffness possible on every job." End caps lock cutters rigidly under an "automatic set screw" which holds tight while tool is cutting but releases cutter instantly for removal.

Of particular interest to tool and die makers is a quick action drill vise which can be instantly adjusted to any size within its capacity; one turn of the handle sets or releases the vise. Armstrong tool holders for lathes, planers, shapers and slotters; turret lathe and screw machine tools of all kinds; clamps; lathe and milling machine dogs and wrenches both open end and socket for all purposes are accurately described.

Copies of catalog TC-39 may be had by writing Armstrong Bros. Tool Company, 333 North Francisco Avenue, Chicago, Illinois.

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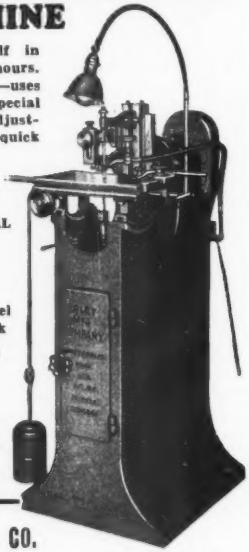

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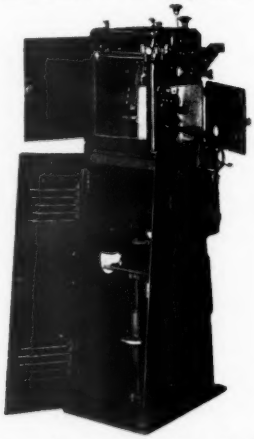

As a result of this cabinet-feature, in case of a change or special spring, both pitch and diameter cams may be shaped, timed and affixed to the cam hub which, as an entire single unit, may be removed from the shaft without losing the timed relations. One-piece solid cams can be used on this removable cam hub.

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● This directory of products lists for ready reference the names of manufacturers and dealers whose sales to Tool·Die·Machine PROGRESS readers have established them as dependable in every sense of the word. They merit your consideration.

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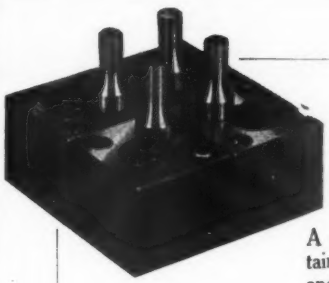

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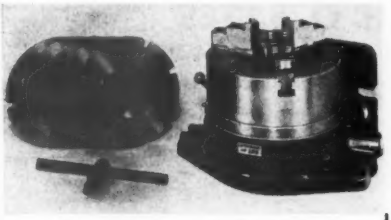

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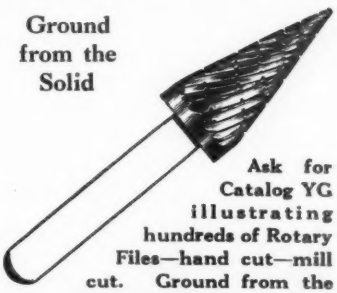

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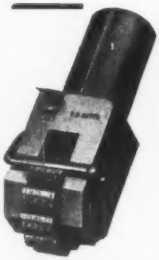

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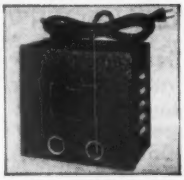

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Estimating a Compound Die

(Continued from Page 16)

tors type 1, less than ⅝" diameter require .5 hr. each..	1.0 hr.
PERFORATOR HOLES	
2 @ 1.3 hrs. each	2.6
OIL PIN	
Type illustrated Fig. 27 "C".	1.7
SPRING PINS	
Table, Fig. 25, Three @ 1 hr. each. Time for locating them is included	3.0
KNOCK-OUT	
Type 3, Fig. 26. Time allowed 2.5 to 5 hrs. Because of double step to be cut into punch holder we estimate	3.5
TOTAL Column E	11.8 hrs.
ASSEMBLING AND TRYOUT	
Table, Fig. 28, indicates time values to be used for assembling the various parts of a compound die.	
Mounting punch pad, die, backing plate to punch holder	3 hrs.
Mounting punch and stripper to die shoe	2
Assembling shedder	1
Mounting No. 2 punch	1
Mounting No. 2 perforators .5 hr. each	1
Tryout	2
TOTAL Column F	10 hrs.
Estimate of total time required for building the die ...	78 hrs.

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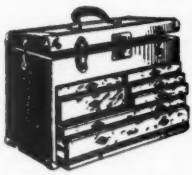

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Important Publication Announcement

The interest shown in George Dannes' series of articles on die estimating has been so widespread that we have acquiesced to the demand for re-publication in more permanent form.

Mr. Dannes' popular method of predetermining die construction costs, based on extensive shop practice, will be available in book form on or about **January 1st, 1940.**

The Tables of Time Values, in addition to appearing in their regular place in the text, will be reproduced in groups on cardboard stock, sized for convenient reference.

The Die Work Estimating Sheet will be available in pads. A set of Tables and one pad of Estimating Sheets will be included with each order for a copy of the book.

The tentative pre-publication price is $1.55, subject to revision after publication or before if paper costs continue to rise. Bulk orders by companies for employees or apprentices and by schools for shop class use will carry a special discount.

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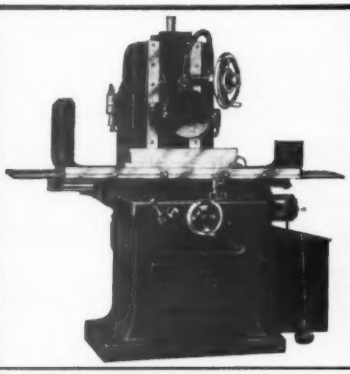

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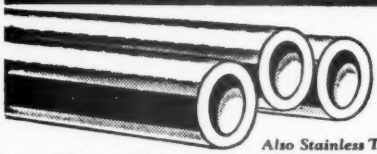

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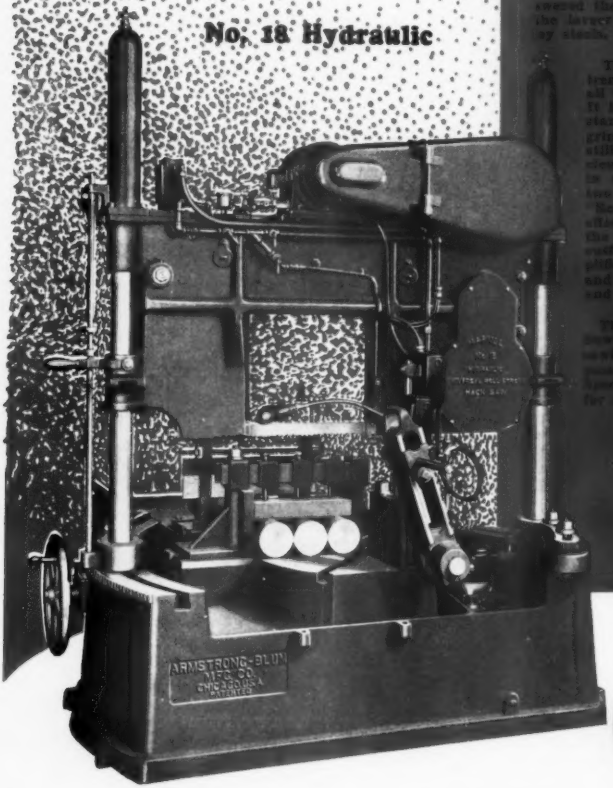

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